

# PHYSICAL EXAMINATIONS FOR DIAGNOSING MENISCAL INJURIES: CORRELATION WITH SURGICAL FINDINGS

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## ABSTRACT

**Objective:** A set of five maneuvers for meniscal injuries (McMurray, Apley, Childress and Steinmann 1 and 2) was evaluated and their sensitivity, specificity, accuracy and likelihood were calculated. The same methods were applied to each test individually. **Methods:** One hundred and fifty-two patients of both sexes who were going to undergo videoarthroscopy on the knee were examined blindly by one of five residents at this hospital, without knowledge of the clinical data and why the patient was going to undergo an operation. This examination was conducted immediately before the videoarthroscopy and its results were recorded in an electronic spreadsheet. The set of maneuvers was considered

positive when one was positive. In the individual analysis, it was enough for the test to be positive. **Results:** The analysis showed that the set of five meniscal tests presented sensitivity of 89%, specificity of 42%, accuracy of 75%, positive likelihood of 1.53 and negative likelihood of 0.26. Individually, the tests presented accuracy of between 48% and 53%. **Conclusion:** The set of maneuvers for meniscal injuries presented a good accuracy and significant value, especially for ruling out injury. Individually, the tests had less diagnostic value, although the Apley test had better specificity.

**Keywords** □ Knee; Arthroscopy; Physical Examination; Video-Assisted Surgery; Comparative Study

## INTRODUCTION

Meniscal injuries (MI) habitually occur in patients who suffer rotational trauma to the knee under compression. They can occur separately or in association with ligament ruptures and chondral pathologies. They are quite often found in the orthopedic practice<sup>(1)</sup> and MIs usually occur during sports<sup>(1)</sup>.

In a recent case, the findings of the physical examination may be limited, insofar as the patient may present a painful knee, restricted range of motion (ROM) and joint effusion<sup>(2)</sup>. When it is a long-standing injury, the efficacy of the tests for detection of MI will be compromised<sup>(3)</sup>. The posterior horn of the medial meniscus is the most common site of meniscal

conditions, while longitudinal ruptures represent the most frequent injuries<sup>(4)</sup>.

With the advance of modern imaging exams, the diagnosis of MIs has become more precise. Magnetic resonance imaging has become the exam of choice for the imaging study of these injuries<sup>(5,6)</sup>, and it is indicated as a highly accurate diagnostic tool<sup>(7-10)</sup>. Accompanying this evolution, arthroscopic therapeutic methods have provided a new scenario for the treatment of meniscal conditions<sup>(11,12)</sup>. In spite of these facts, it is firmly established in the current literature that anamnesis and the physical examination are directly related to the diagnosis of MIs<sup>(13-17)</sup>, and are pointed out, by Wagemakers *et al*<sup>(3)</sup>, as having a slightly su-

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perior value to magnetic resonance imaging.

Kocabey *et al*<sup>(18)</sup> evaluated the painful joint line, McMurray, Steinmann and modified Apley tests. This set of tests presented accuracy of 80% for the medial meniscus and 92% for the lateral meniscus<sup>(18)</sup>. The aim of our study is to calculate the sensitivity, specificity, accuracy, positive and negative likelihood of the McMurray, Steinmann, Apley and Childress (duck waddle) tests both separately and jointly.

## MATERIAL AND METHODS

A cross-sectional study, with prospective data collection performed between January 2008 and June 2009. Two of the five Orthopedics and Traumatology residents of Hospital São Lucas, PUCRS, examined 162 patients (163 knees) with meniscal and/or ACL injury who were going to undergo knee videoarthroscopy afterwards. The examiners, who received specific training to perform meniscal maneuvers, were not familiar with the patients' clinical data, or the reason for surgery. The physical examination was performed prior to surgery and its results were compared with the surgical findings. The residents selected 117 male patients and 45 female patients over 18 years of age (mean age of 39.03 years) with traumatic or degenerative knee injuries.

The set of maneuvers performed for the MI diagnosis was composed of the McMurray *apud* Tria<sup>(19)</sup>, Apley<sup>(20)</sup>, Childress, Steinmann I and II tests<sup>(19)</sup>.

The physical examination was conducted by two residents; in the event of a tie, a third resident was recruited to examine the patient. The result was written down by this examiner, who marked the test positive or negative. For the set of maneuvers, it was considered a positive physical examination when one of them was positive. The maneuvers were also considered positive or negative in separate form.

The arthroscopic assessment of the knee was performed at the surgical center, always by one of the two orthopedists specialized in the knee, on patients who presented previous surgical indication, but did not present exams and clinical data reported to the three orthopedic residents who were performing the physical examination proposed in the study. Arthroscopies were performed through the classic parapatellar, anterolateral and anteromedial portals. After insertion of the arthroscope through the lateral parapatellar portal, a routine inspection was carried

out on the whole joint in all the cases, analyzing the medial and lateral compartments (condyles, plateaus and menisci), intercondyle (cruciate ligaments), and finally the femoropatellar joint (patellar and synovial cartilages). Investigation through medial and lateral suprapatellar portals was performed as necessary. The injuries were identified and recorded for comparison with the physical examination. After the inspection, the lesions were surgically corrected as necessary. Videoarthroscopies were not performed in patients without indication for surgical treatment (videosurgery) for their disease.

Any type of meniscal injury found in the transoperative period was considered a positive finding, regardless of whether it was radial or longitudinal, simple or complex, traumatic or degenerative.

The study was submitted and approved by the research ethics committee of the institution where it was conducted, and all the patients read and signed the informed consent form. The data were filed in a *MS Office-Excel 2007* spreadsheet and evaluated by *BioEstat 5.0* software. The accuracy, sensitivity and specificity of the tests were evaluated jointly.

## RESULTS

Of the 162 patients included in the study, 124 presented meniscal injury, while 82 (66.12%) had an injury involving the medial meniscus (MM), 42 (33.87%) the lateral meniscus (LM) and 10 (8.06%) had both menisci injured (Table 1).

**Table 1** – Results relating to the distribution of medial and lateral meniscal injuries.

	MM	LM	Both M	TOTAL
MI	82 (66.12%)	42 (33.87%)	10 (8.06%)	124 (100%)

As observed in the Table 2, the analysis showed that the set of the five meniscal tests presented 89% of sensitivity for the MM and 85% of sensitivity for the LM. As regards specificity, the values were 31% for the MM and 24% for the LM, which led us to a calculation of 60% of accuracy for the MM and 40% for the LM. The positive likelihood was 1.29 in the MM and 1.13 in the LM. The negative likelihood was 0.35 for the MM and 0.59 for the LM.

In Table 3 we analyzed each test separately, with their respective values of accuracy, likelihoods, sensitivity and specificity. The Apley test presented

**Table 2** – Sensitivity, specificity, positive likelihood, negative likelihood of the set of tests.

MM Set		LM Set	
Sensitivity	89.02%	Sensitivity	85.71%
Specificity	31.25%	Specificity	24.17%
Positive Likelihood	1.29	Positive Likelihood	1.13
Negative Likelihood	0.35	Negative Likelihood	0.59
Accuracy	60.49%	Accuracy	40.00%

MM: medial meniscus; LM: lateral meniscus.

specificity of 65% for the MM and 60% for the LM; therefore these values are higher than those of the other tests. As regards accuracy, Steinmann I and II tests presented values of around 62% for the detection of MM injury. The accuracy of the isolated tests was greater in the MM examination, with the exception of the Apley test in which it was the same.

## DISCUSSION

To verify the value of the physical examination in the detection of meniscal injuries of the knee, we used arthroscopy as the standard method, like in the vast majority of similar studies<sup>(18,20-23)</sup>.

Some provocative tests are described with the intention of identifying symptoms involving the menisci. The tests used in this study can be divided into two groups. The first group includes the tests that depend on palpation or clicking sensation at the joint line, such as the McMurray and Steinmann II tests. The positive McMurray test for medial meniscus is

demonstrated with external rotation of the tibia and passive movement from flexion to extension. For lateral meniscus, it is demonstrated with internal rotation of the tibia and passive movement from flexion to extension. The Steinmann II test demonstrates pain at the interline that moves posteriorly when the knee is flexed and anteriorly when the knee is extended.

The second group contains the tests that depend on pain with rotation. The Apley test is carried out through compression and distraction between the tibiofemoral joint surface in flexion. If the distraction promotes less discomfort than the compression, it indicates meniscal pain instead of a joint disorder. The Childress (duck waddle) test provokes compressive force on the posterior horn of the meniscus causing pain. The Steinmann I test is carried out with the knee flexed at 90 degrees and a sudden external rotatory force is applied on the tibia to test the medial meniscus. The result is pain along the medial joint line. Internal tibial rotation is used for lateral meniscal pain<sup>(19)</sup>.

Manzotti *et al*<sup>(23)</sup> demonstrated in their study that the McMurray's maneuver presents greater sensitivity for medial meniscus injuries when compared to the lateral meniscus, a fact that was confirmed in our study. Evans *et al*<sup>(21)</sup>, taking into account just joint snapping for the positivity of the McMurray test, concluded that this has specificity of 98% and sensitivity of 16%. Our study showed a lower specificity, yet a

**Table 3** – Sensitivity, specificity, positive likelihood, negative likelihood of the tests separately.

MC MM		MC LM		STI MM		STI LM	
Sensitivity	64.63%	Sensitivity	61.90%	Sensitivity	69.51%	Sensitivity	59.52%
Specificity	57.50%	Specificity	49.17%	Specificity	56.25%	Specificity	44.17%
Positive Likelihood	1.52	Positive Likelihood	1.22	Positive Likelihood	1.59	Positive Likelihood	1.07
Negative Likelihood	0.62	Negative Likelihood	0.77	Negative Likelihood	0.54	Negative Likelihood	0.92
Accuracy	61.10%	Accuracy	52.46%	Accuracy	62.96%	Accuracy	48.14%
STII MM		STII LM		CH MM		CH LM	
Sensitivity	68.29%	Sensitivity	59.52%	Sensitivity	63.41%	Sensitivity	73.81%
Specificity	56.25%	Specificity	45.00%	Specificity	45.00%	Specificity	45.83%
Positive Likelihood	1.56	Positive Likelihood	1.08	Positive Likelihood	1.15	Positive Likelihood	1.36
Negative Likelihood	0.56	Negative Likelihood	0.9	Negative Likelihood	0.81	Negative Likelihood	0.57
Accuracy	62.34%	Accuracy	48.76%	Accuracy	54.32%	Accuracy	53.00%
AP MM		AP LM					
Sensitivity	50.00%	Sensitivity	50.00%				
Specificity	65.00%	Specificity	60.00%				
Positive Likelihood	1.43	Positive Likelihood	1.25				
Negative Likelihood	0.77	Negative Likelihood	0.83				
Accuracy	57.40%	Accuracy	57.40%				

MC: McMurray; STI – STII: Steinmann I – II; CH: Childress; AP: Apley; MM: medial meniscus; LM: lateral meniscus.

higher sensitivity in relation to Evans' study for this test.

Meserve *et al*<sup>(24)</sup>, in their meta-analysis, showed that the Apley test presents superior specificity when compared to McMurray's maneuvers and painful palpation of the joint line. However, as regards sensitivity, the Apley test presented much lower values. These data were similar to those of our study when the Apley test was compared to another four maneuvers.

Steinmann I and II tests are not often used to test the accuracy of the physical examination in studies of greater relevance. Kocabey *et al*<sup>(18)</sup> cited Steinmann's maneuver in their study, yet did not specify whether it was Steinmann I or II, showing the data together with other maneuvers. Through our results it is possible to notice that both Steinmann I and II have superior accuracy over the other tests in relation to the medial meniscus.

Fowler and Lubliner<sup>(17)</sup> stressed that no meniscal test is predictive for the diagnosis, and that the set of maneuvers should be used. Kocabey *et al*<sup>(18)</sup>

compared the accuracy of the set of maneuvers with that of nuclear magnetic resonance (NMR) in their study. Through their data, they concluded that the physical examination has superior accuracy to that of NMR with sensitivity results that resemble ours (MM 87% – LM 75%). Accordingly, in patients with strong suspicion of injury, the set of maneuvers can be very useful for ruling out this suspicion.

All the isolated tests, except for the Apley test, presented greater sensitivity than specificity. A test with high sensitivity is used mainly to exclude the presence of a pathology.

## CONCLUSION

The set of maneuvers for meniscal injuries has good accuracy and significant value, particularly to exclude injuries. The isolated tests have lower diagnostic value, while the Apley test is that with the best specificity.

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